CLAIMS

We claim:

1. A method of forming a bond between members of a Micro-Electro-Mechanical System (MEMS), wherein the members each have mating surfaces at which the bond may be formed, the method comprising:

depositing a first layer of material on a first mating surface, wherein the first layer of material is selected from the group consisting of gold and tin;

depositing a second layer of material on a second mating surface, wherein the second layer of material is selected from the group consisting of indium and lead; and

pressing the first mating surface and the second mating surface together, thereby pressing the first layer of material to the second layer of material, thereby forming an alloy to serve as the bond between the mating surfaces of the members of the MEMS.

2. The method of Claim 1, wherein pressing the first mating surface and the second mating surface together includes a Solid-Liquid InterDiffusion (SLID) bonding process.

3. The method of Claim 1, wherein pressing the first mating surface and the second mating surface together is done at a temperature between about 20°C to about 200°C.

4. The method of Claim 1, wherein pressing the first mating surface and the second mating surface together is done at a pressure of about 2 pounds per square inch.

5. The method of Claim 1, wherein pressing the first mating surface and the second mating surface together is done for about 6 hours.

6. The method of Claim 1, wherein the first layer of material has a thickness between about 100 Angstroms to about 0.25 inches.

7. The method of Claim 1, wherein the second layer of material has a thickness between about 50 Angstroms to about 0.125 inches.

8. The method of Claim 1, wherein the members of the MEMS are selected from the group consisting of a substrate, a micro-machine, a cover, and a micro-machine chip.

9. The method of Claim 8, wherein the cover is comprised of a material selected from the group consisting of a silicon, a glass and a ceramic material.

10. The method of Claim 1, wherein pressing the first mating surface and the second mating surface together is done at a pressure of about 2 pounds per square inch and at a temperature of about 100°C.

11. The method of Claim 1, wherein pressing the first mating surface and the second mating surface together is done at a pressure of about 2 pounds per square inch and is done for about 6 hours.

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12. The method of Claim 1, wherein pressing the first mating surface and the second mating surface together is done for about 6 hours at a temperature of about 100°C.

13. The method of Claim 1 further comprising depositing a first layer of mating material on the first mating surface and depositing a second layer of mating material on the second mating surface prior to depositing the first layer of material on the first mating surface and depositing the second layer of material on the second mating surface.

14. The method of Claim 13, wherein the first layer of mating material and the second layer of mating material are comprised of layers of chromium each having a thickness between about 5 Angstroms to about 100 Angstroms.

15. The method of Claim 1, wherein pressing the first mating surface and the second mating surface together is done using an effective amount of pressure and temperature, for an effective amount of time to form the alloy to serve as the bond between the mating surfaces of the members of the MEMS.

16. A method of forming a bond between members of a Micro-Electro-Mechanical System (MEMS), wherein the members each have mating surfaces at which the bond may be formed, the method comprising:

depositing a layer of gold on a first mating surface;

depositing a layer of indium on a second mating surface; and

pressing the first mating surface and the second mating surface together, thereby pressing the layer of gold to the layer of indium, thereby forming a gold-indium alloy to serve as the bond between the members of the MEMS.

17. The method of Claim 16, wherein pressing the first mating surface and the second mating surface together includes a Solid-Liquid InterDiffusion (SLID) bonding process.

18. The method of Claim 16, wherein pressing the first mating surface and the second mating surface together is done at a temperature between about 20°C to about 200°C.

19. The method of Claim 16, wherein pressing the first mating surface and the second mating surface together is done at a pressure of about 2 pounds per square inch.

20. The method of Claim 16, wherein pressing the first mating surface and the second mating surface together is done for about 6 hours.

21. The method of Claim 16, wherein pressing the first mating surface and the second mating surface together is done at a pressure of about 2 pounds per square inch and at a temperature of about 100°C.

22. The method of Claim 16, wherein pressing the first mating surface and the second mating surface together is done at a pressure of about 2 pounds per square inch and is done for about 6 hours.

23. The method of Claim 16, wherein pressing the first mating surface and the second mating surface together is done for about 6 hours at a temperature of about 100°C.

24. The method of Claim 16, wherein the layer of gold has a thickness between about 100 Angstroms to about 0.25 inches.

25. The method of Claim 16, wherein the layer of indium has a thickness between about 50 Angstroms to about 0.125 inches.

26. The method of Claim 16, wherein the members of the MEMS are selected from the group consisting of a substrate, a micro-machine, a cover, and a micro-machine chip.

27. The method of Claim 16, wherein the cover is comprised of a material selected from the group consisting of a silicon, a glass and a ceramic material.

28. The method of Claim 16 further comprising depositing a first layer of mating material on the first mating surface and depositing a second layer of mating material on the second mating surface prior to depositing the layer of gold on the first mating surface and depositing the layer of indium on the second mating surface.

29. The method of Claim 28, wherein the first layer of mating material and the second layer of mating material are comprised of layers of chromium each having a thickness between about 5 Angstroms to 100 Angstroms.

30. The method of Claim 16, wherein pressing the first mating surface and the second mating surface together is done using an effective amount of pressure and temperature, for an effective amount of time to form the gold-indium alloy to serve as the bond between the members of the MEMS.

31. A Micro-Electro-Mechanical System (MEMS) comprising in combination:

a substrate comprising a base;

a micro-machine coupled to the substrate; and

a cover coupled to the substrate, the cover mounted over the micro-machine,

wherein the cover and the micro-machine are coupled to the substrate by forming at least one bond between the cover and the substrate and between the micro-machine and the substrate, wherein the cover, the micro-machine, and the substrate each have mating surfaces at which the at least one bond may be formed, and wherein the at least one bond is formed by:

depositing a first layer of material on a first mating surface, wherein the first layer of material is selected from the group consisting of gold and tin;

depositing a second layer of material on a second mating surface, wherein the second layer of material is selected from the group consisting of indium and lead; and

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pressing the first layer of material to the second layer of material, thereby forming an alloy to serve as the at least one bond between the mating surfaces of the cover and the substrate and between the mating surfaces of the micro-machine and the substrate.

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32. The MEMS of Claim 31, wherein the alloy serving as the at least one bond is selected from the group consisting of a gold-indium alloy, a gold-lead alloy, a tin-indium alloy, and a tin-lead alloy.

33. The MEMS of Claim 31, wherein the at least one bond is formed by a Solid-Liquid InterDiffusion (SLID) bonding process.

34. The MEMS of Claim 31, wherein the at least one bond is formed by pressing the first layer of material to the second layer of material at a temperature between about 20°C to about 200°C.

35. The MEMS of Claim 31, wherein the at least one bond is formed by pressing the first layer of material to the second layer of material at a pressure of about 2 pounds per square inch.

36. The MEMS of Claim 31, wherein the at least one bond is formed by pressing the first layer of material to the second layer of material for about 6 hours.

37. The MEMS of Claim 31, wherein the first layer of material has a thickness between about 100 Angstroms to about 0.25 inches.

38. The MEMS of Claim 31, wherein the second layer of material has a thickness between about 50 Angstroms to about 0.125 inches.

39. The MEMS of Claim 31, wherein the at least one bond is formed by pressing the first layer of material to the second layer of material at a pressure of about 2 pounds per square inch and at a temperature of about 100°C.

40. The MEMS of Claim 31, wherein the at least one bond is formed by pressing the first layer of material to the second layer of material for about 6 hours at a pressure of about 2 pounds per square inch.

41. The MEMS of Claim 31, wherein the at least one bond is formed by pressing the first layer of material to the second layer of material for about 6 hours at a temperature of about 100°C.

42. The MEMS of Claim 31, wherein the at least one bond is formed by depositing a first layer of mating material on the first mating surface and depositing a second layer of mating material on the second mating surface prior to depositing the first layer of material on the first mating surface and depositing the second layer of material on the second mating surface.

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43. The MEMS of Claim 42, wherein the first layer of mating material and the second layer of mating material are comprised of layers of chromium each having a thickness between about 5 Angstroms to about 100 Angstroms.

44. The MEMS of Claim 31 further comprising a plurality of components movably coupled to the micro-machine, the plurality of components operable to perform mechanical operations.

45. The MEMS of Claim 44, wherein the cover includes a cavity to provide open space to allow the plurality of components to move freely.

46. The MEMS of Claim 31, wherein the at least one bond is formed by pressing the first layer of material to the second layer of material using an effective amount of pressure and temperature, for an effective amount of time to form the alloy to serve as the at least one bond between the mating surfaces of the cover and the substrate and between the mating surfaces of the micro-machine and the substrate.

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